Facts About Dietary Supplements

Clinical Nutrition Service, Warren Grant Magnuson Clinical Center • Office of Dietary Supplements • National Institutes of Health

Zinc

As a consumer, you need information you can trust to help you make thoughtful decisions about eating a healthful diet and using vitamin and mineral supplements. Registered dietitians at the Warren Grant Magnuson Clinical Center, the clinical research hospital at the National Institutes of Health (NIH) in Bethesda, MD, developed this series of Fact Sheets in conjunction with the Office of Dietary Supplements in the Office of the Director of NIH to provide responsible information about the role of vitamins and minerals in health and disease and to help guide your decisions on the use of vitamin and mineral supplements. Each fact sheet in this series received extensive scientific review by recognized experts from the academic and research communities. The information is not intended to be a substitute for professional medical advice. It is important that you seek the advice of a physician about any medical condition or symptom. It is also important to seek the advice of a physician, registered dietitian, pharmacist, or other qualified health care professional about the appropriateness of taking dietary supplements and their potential interactions with medications.

Zinc: What is it?

Zinc is an essential mineral that is found in almost every cell in your body. It stimulates the activity of approximately 100 enzymes, which are substances that promote biochemical reactions in your body (1,2). It is also important for a healthy immune system (3), for healing cuts and wounds (3,4), and for maintaining your sense of taste and smell (5,6). Zinc also supports normal growth and development during pregnancy, childhood, and adolescence (7, 8). A less known but equally important function of zinc is its role in regulating gene expression (1).

What foods provide zinc?

Zinc is widely distributed in foods (2). Red meat and poultry provide the majority of zinc in the American diet. Other food sources include beans, nuts, certain seafood, whole grains, fortified breakfast cereals, and dairy products (2,9). Oysters contain more zinc by weight than any other food, but beef is a more common source in the U.S. diet. Zinc absorption is greater from a diet high in animal protein than a diet rich in plant proteins, including soy (2). Phytates, which are found in whole grain breads, cereals, legumes and other products, can decrease zinc absorption (2, 10, 11). The Table of Selected Food Sources of Zinc lists a variety of dietary sources of zinc.

What is the Recommended Dietary Allowance for zinc?

Dietary Reference Intakes (DRIs) are reference values used for planning and assessing diets for healthy people. The Recommended Dietary Allowance (RDA), one of the DRIs, recommends the average daily dietary intake level that is sufficient to meet the nutrient requirements of nearly all (97-98%) healthy individuals in each age and gender group (2). There is insufficient information available to establish a RDA in infants from birth through 6 months, but an intake of 2.0 mg zinc per day is considered adequate for this group (2). The 2001 RDAs for zinc (2) for children and adults, in milligrams (mg), are:

Age	Infants and Children	Men	Women	Pregnancy	Lactation
7 mos - 3 yrs	3 mg				
4 - 8 years	5 mg				
9 - 12 years	8 mg				
14-18 years		11 mg	9 mg	13 mg	14 mg
Ages 19+		11 mg	8 mg	11 mg	12 mg

Results of two national surveys, the National Health and Nutrition Examination Survey (NHANES III 1988-91) (12) and the Continuing Survey of Food Intakes of Individuals (1994 CSFII) (13) indicated that most infants, children, and adults consume recommended amounts of zinc.

When can zinc deficiency occur?

Zinc deficiency can occur when zinc intake is inadequate, when there are increased losses of zinc from the body, or when the body's requirement for zinc increases (14, 15). There is no specific deficiency disease associated with zinc. Instead, many general signs of zinc deficiency can appear, including growth retardation, hair loss, diarrhea, delayed sexual maturation and impotence, eye and skin lesions, and loss of appetite (2). There is also some evidence that weight loss, delayed healing of wounds, taste abnormalities, and mental lethargy can occur (3, 4, 15 - 19). Some of these symptoms can also result from a variety of medical conditions other than zinc deficiency. It is important to have a physician evaluate these symptoms so that appropriate medical care can be given.

Who may need extra zinc?

There is no single laboratory test available to determine zinc nutritional status (20). People who may benefit from a zinc supplement include those who do not consume enough calories, vegetarians, some older infants and children with impaired growth, and people who suffer from alcoholism or digestive diseases that cause malabsorption and diarrhea (2).

Vegetarians may need as much as 50% more zinc than non-vegetarians because of the decreased absorption of zinc from plant foods (2, 21).

Zinc supplementation has improved growth rate in some children who demonstrate mild to moderate growth failure and who also have a mild zinc deficiency (22). Maternal zinc deficiency can delay fetal growth, and mothers who give birth to small for gestational age babies have been found to have lower zinc intakes during pregnancy (6). Human milk does not provide recommended amounts of zinc for older infants between the ages of 7 months and 12 months, so breast-fed infants of this age should also consume foods containing zinc or be given formula containing zinc (2). Alternately, a physician may recommend supplemental zinc in this situation. Breastfeeding also may deplete maternal zinc stores because of the greater need for zinc during lactation (23). It is important for mothers who breast-feed to include good sources of zinc in their daily diet.

Low zinc status has been observed in 30% to 50% of alcoholics. Alcohol decreases the absorption of zinc and increases loss of zinc in urine. In addition, many alcoholics do not eat an acceptable variety or amount of food, so their dietary intake of zinc may be inadequate (2, 24, 25).

Diarrhea results in a loss of zinc. Individuals who have had gastrointestinal surgery or who have digestive disorders that result in malabsorption, including sprue, Crohn's disease and short bowel syndrome, are at greater risk of a zinc deficiency (2, 15, 26). Individuals who experience chronic diarrhea should make sure they include sources of zinc in their daily diet (see selected table of food sources of zinc) and may benefit from zinc supplementation. A medical doctor can evaluate the need for a zinc supplement if diet alone fails to maintain normal zinc levels in these circumstances.

What are some current issues and controversies about zinc?

Zinc, infections, and wound healing

The immune system is adversely affected by even moderate degrees of zinc deficiency. Severe zinc deficiency results in severely depressed immune function and frequent infections (27). Zinc is required for the development and activation of T-lymphocytes, a kind of white blood cell that helps fight infection (2, 28). When zinc supplements are given to individuals with low zinc levels, the numbers of T-cell lymphocytes circulating in the blood increase and the ability of lymphocytes to fight infection improves. Studies show that poor, malnourished children in India, Africa, South America, and Southeast Asia experience shorter courses of infectious diarrhea after taking zinc supplements (29). Zinc supplements are often given to help heal skin ulcers or bed sores (30), but they do not increase rates of wound healing when zinc levels are normal.

Zinc and the common cold

The effect of zinc treatments on the severity or duration of cold symptoms is controversial. A study of over 100 employees of the Cleveland Clinic indicated that zinc lozenges decreased the duration of colds by one-half, although no differences were seen in how long fevers lasted or the level of muscle aches (31). Some researchers have criticized this study by questioning whether participants knew if they were receiving treatment (zinc lozenges often have a bad taste that is difficult to conceal). Turner el al conducted two studies to examine the effect of zinc supplements on cold duration and severity in over 400 randomized subjects. In their first study, a virus was used to induce cold symptoms. The duration of illness was significantly lower in the group receiving zinc gluconate but not in the group receiving zinc acetate, and none of the zinc preparations affected the severity of cold symptoms in the first 3 days of treatment. In the second study, which examined the effects of zinc supplements on duration and severity of natural colds, no differences were seen between individuals receiving zinc and those receiving a placebo (sugar pill) (32). Recent research suggests that the effect of zinc may be influenced by the ability of the specific supplement formula to deliver zinc ions to the oral mucosa (32). Additional research is needed to determine whether zinc compounds have any effect on the common cold.

Zinc and iron absorption

Iron deficiency anemia is considered a serious public health problem in the world today. Iron fortification programs were developed to prevent this deficiency, and they have been credited with improving the iron status of millions of women, infants, and children. Some researchers, however, have raised concern about the effects of iron fortification on the absorption of other nutrients, including zinc. Foods fortified with iron generally do not affect zinc absorption. High levels of iron found in some supplements can decrease zinc absorption, as can iron in solutions (2, 33).

What is the health risk of too much zinc?

Zinc toxicity has been seen in both acute and chronic forms. Intakes of 150 to 450 mg of zinc per day have been associated with low copper status, altered iron function, reduced immune function, and reduced levels of high-density lipoproteins (the good cholesterol) (34). One case report cited severe nausea and vomiting within 30 minutes after the person ingested four grams of zinc gluconate (570 mg elemental zinc) (35). In 2001 the National Academy of Sciences established tolerable upper levels (UL), the highest intake associated with no adverse health effects, for zinc for infants, children, and adults (2). The ULs do not apply to individuals who are receiving zinc for medical treatment, but it is important for such individuals to be under the care of a medical doctor who will monitor for adverse health effects. The 2001 Upper Levels for infants, children and adults are (2):

Table of Upper Limits for Zinc for Infants, Children, and Adults

Age	Infants and Children	Men	Women	Pregnancy	Lactation
0 - 6 mos	4 mg				
7 - 12 mos	5 mg				
1 - 3 years	7 mg				
4 - 8 years	12 mg				
9 - 13 years	23 mg				
14 - 18 years	34 mg			34 mg	34 mg
Ages 19+		40 mg	40 mg	40 mg	40 mg

Selected Food Sources of Zinc

The 2000 Dietary Guidelines for Americans state, "Different foods contain different nutrients and other healthful substances. No single food can supply all the nutrients in the amounts you need" (36). The following table suggests a variety of dietary sources of zinc. As the table indicates, red meat, poultry, fortified breakfast cereal, some seafood, whole grains, dry beans, and nuts supply zinc to your diet. Fortified foods including breakfast cereals make it easier to consume the RDA for zinc, however they also make it easier to consume too much zinc, especially if supplemental zinc is being taken. Anyone considering taking a zinc supplement should first consider whether their needs are being met by dietary zinc and from fortified foods.

If you want more information about building a healthful diet, refer to the Dietary Guidelines for Americans and the Food Guide Pyramid.

Table of Selected Food Sources of Zinc (9)

Food	*Milligrams*	*% DV**
Oysters, battered, fried, 6 pieces	15.0	100
Breakfast cereal, fortified with 100% of the DV for zinc per serving, 3/4 c serving	15.0	100
Beef shank, lean only, cooked 3 oz	8.9	60
Beef chuck, arm pot roast, lean only, cooked, 3 oz	7.4	45
Beef tenderloin, lean only, cooked, 3 oz	4.8	30
Pork shoulder, arm picnic, lean only, cooked, 3 oz	4.2	30
Beef, eye of round, lean only, cooked 3 oz	4.0	25
Breakfast cereal, fortified with 25% of the DV for zinc, 3/4 c	3.7	25
Breakfast cereal, complete wheat bran flakes, 3/4 c	3.7	25
Chicken leg, meat only, roasted, 1 leg	2.7	20
Pork tenderloin lean only, cooked, 3 oz	2.5	15
Pork loin, sirloin roast, lean only, cooked, 3 oz	2.2	15

Table of Selected Food Sources of Zinc (9)

Food	*Milligrams*	*% DV**
Yogurt, plain, low fat, 1 c	2.2	15
Baked beans, canned w/ pork, 1/2 c	1.8	10
Baked beans, canned, plain or vegetarian, 1/2 c	1.7	10
Cashews, dry roasted w/out salt, 1 oz	1.6	10
Yogurt, fruit, low fat, 1 c	1.6	10
Pecans, dry roasted w/out salt, 1 oz	1.4	10
Raisin bran, 3/4 c	1.3	8
Chickpeas, mature seeds, canned, 1/2 c	1.3	8
Mixed nuts, dry roasted w/peanuts, w/out salt, 1 oz	1.1	8
Cheese, Swiss, 1 oz	1.1	8
Almonds, dry roasted, w/out salt, 1 oz	1.0	6
Walnuts, black, dried, 1 oz	1.0	6
Milk, fluid, any kind, 1 c	1.0	6

Table of Selected Food Sources of Zinc (9)

Food	*Milligrams*	*% DV**
Chicken, breast, meat only, roasted, 1/2 breast w/ bone and skin removed	0.9	6
Cheese, cheddar, 1 oz	0.9	6
Cheese, mozzarella, park-skim, low moisture, 1 oz	0.9	6
Beans, kidney, California red, cooked, 1/2 c	0.8	6
Peas, green, frozen, boiled, 1/2 c	0.8	6
Oatmeal, instant, low sodium, 1 packet	0.8	6
Flounder/sole, cooked, 3 oz	0.5	4

* DV = Daily Value. DVs are reference numbers based on the Recommended Dietary Allowance (RDA). They were developed to help consumers determine if a food contains very much of a specific nutrient. The DV for zinc is 15 milligrams (mg). The percent DV (%DV) listed on the nutrition facts panel of food labels tells adults what percentage of the DV is provided in one serving. Percent DVs are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs. Foods that provide lower percentages of the DV also contribute to a healthful diet.

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National Institutes of Health
Warren Grant Magnuson Clinical Center
Bethesda,Maryland 20892

Technical questions about this site?
pepub_webmaster@nih.gov

Questions about the Clinical Center? OCCC@cc.nih.gov